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ABSTRACT

Continued interest in second language acquisition as a reflection of first language acquisition may be due to increasing evidence of universals in child language acquisition. Some research has indicated that second language acquisition patterns do not match first language acquisition patterns. Rather than arguing that second language acquisition is somehow independent of the first language, which would involve positing separate cognitive phenomena for first and second language acquisition, it may be more productive to examine first and second language items in terms of a subtle interaction with each other. The ordering-theoretic method, when applied to the bilingual child, can reveal whether there is any interaction between the first and second language. First grade bilingual students (Spanish-English and Navajo-English) were tested according to this technique. The subjects heard 30 sentences involving 10 semantic categories, specifically, concepts of numeric comparison, and were asked to judge whether accompanying illustrations matched the sentence. Findings include: (1) there is no clear-cut distinction between the bilingual child's two languages even in a single domain, and (2) some pairs of semantic categories do not reveal a causal relationship. The bilingual pattern of an ordering-theoretic hierarchy seems to demonstrate that the notion of linguistic dominance is not limited to broad domains, and suggests a differential first and second language relationship. (AM)

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A Theoretic Ordering of Semantic Categories in English, Spanish, and Navajo

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A Theoretic Ordering of Semantic Categories
in English, Spanish, and Navajo

Considerable interest continues to be expressed in how children acquire second languages. Apparently much of this interest stems from the need to gain insight into how to teach children a second language. Kelly (1969) documented that the history of second language methodology has been essentially one of varying from one approach to another and back again for 25 centuries. Nonetheless, scholars and teachers continue to pursue the topic, hoping to eventually find some of the answers that will facilitate teaching and learning of second languages. Of course, additional motivation comes from direct interest in the psychology of second language acquisition. In that acquisition of a first language is obviously a universal human phenomenon and that acquisition of a second language is also within the realm of human accomplishment, any understanding of these processes adds to the general understanding of human ability. What may be especially relevant is any new insight into what it means to be bilingual.

One of the primary research emphases has been on discovering the steps a child goes through in acquiring his second language in relation to his first language. This continued interest in second language acquisition as a reflection of first language acquisition may well be due to increasing evidence of some universality among children in acquiring their first language (Brown, 1973). As evidence has grown documenting the steps that a child goes through in acquiring his first language and as this evidence is pulled together into a comprehensive picture, it becomes increasingly

possible to make useful comparisons between second and first language acquisition.

An especially interesting perspective has come from the work of Dulay and Burt (1972, 1973, 1974a, 1974b, and 1974c). They have argued that neither the semantic nor grammatical complexity that Brown (1973) used to account for acquisition sequence of fourteen first language functors could explain the acquisition sequence of nine of these functors when in a second language. The functors that both Brown and Dulay and Burt used were -ing, plural, past-irregular, possessive, articles, past-regular, third person, copula, auxiliary. The other functors studied by Brown were in, on, uncontractible copula, third person irregular, uncontractible auxiliary. Brown used both cumulative semantic complexity and cumulative grammatical complexity to account for the acquisition order of fourteen functors. Semantic complexity is a reflection of the number of meaning units and grammatical complexity is the number of transformations, following Jacobs and Rosenbaum (1968). Brown argued that grammatical or semantic complexity had to be viewed as cumulative to avoid assuming that each increment in the complexity index was equal. Cumulative complexity indicated that items including smaller units had to be more complex than any of the smaller units and that items containing three units, for example, were more complex than items containing only two of the same units. However, Brown's "explained" acquisition order for nine of his fourteen functors was not matched when in a second language. Even though semantic complexity might be considered moot for second language learners, linguistic complexity was still inadequate to explain the acquisition order in the second language (see Dulay and Burt, 1974c). In fact, Brown found his acquisition hierarchy was as

well explained by both semantic complexity and grammatical complexity and that he could not separate the two.

Dulay and Burt's argument remains intriguing because of their earlier finding that second language acquisition of 11 functors, including the nine referred to earlier, for two different groups of children were virtually identical. A group of Spanish-speaking children and a group of Chinese-speaking children who were acquiring English as a second language were tested with "an expanded version" of the Bilingual Syntax Measure (Burt, Dulay and Hernandez, 1973), which elicits speech in response to pictures and open-ended questions. From their analysis Burt and Dulay stated, "The same sequence of acquisition of 11 functors, obtained by three different methods, provides strong evidence that children exposed to natural L2 speech acquire certain structures in a universal order (Burt and Dulay, 1974a, p.50)." Yet the acquisition order in the second language of these groups did not parallel the acquisition order for first language as documented by Brown for the nine functors in common. The question seems to remain open as to what predicts the order of acquisition of second language items, although Larsen-Freeman (1976) suggested that it was simple frequency. The frequency explanation is, of course, based on a standard behaviorist notion, a notion which has not been productive in explaining first language acquisition. The Larsen-Freeman explanation, however, may be sufficient.

In addition to their finding that the second language acquisition pattern did not match the first language acquisition pattern, Dulay and Burt also offered a branching hierarchy approach for the linguistic items rather than a simple ranking. This branching hierarchy technique was developed by Bart and Krus (1973) and is basically an adaptation of

Guttman Scaling. Termed an ordering-theoretic method, this technique goes beyond ranking and actually offers a way to state that one item presupposes the existence of another item on the basis that no disconfirming evidence is found. In other words, this branching hierarchy is based on causal relationships among the items being investigated. Although Dulay and Burt have not made a comparison of a branching hierarchy of second language items with a similar branching hierarchy of first language items, this approach might help answer the question of the differences between first and second language acquisition. In fact, this approach may well be the beginning of the answer to the complicated relationship between second language acquisition and first language acquisition, assuming that simple frequency proves to be inadequate.

Much of Dulay and Burt's work has been intended to answer the question of how children acquire second languages as evidenced by whether the majority of second language errors would be interference errors or developmental errors. Interference errors, of course, would be over-generalizations of first language rules into the second language situation. Developmental errors would be over-generalizations of earlier acquired rules to new situations or incompletely learned rules. Their research has primarily supported the notion of developmental errors, which has been construed as evidence of "the creative construction process" for second language acquisition, as it is for first language. In first language, the determinant of acquisition order seems to be accumulating linguistic complexity (semantic and syntactic) and developing cognitive abilities (Brown, 1973). The difficulty lies in trying to account for a different acquisition order in a second language. From this dilemma it may be possible to make some

inferences about second language acquisition sequence in relation to first language if the ordering-theoretic method is applied to comparable first and second language items simultaneously.

If there is an invariant order of acquisition of certain first language linguistic units and an invariant but different order for acquisition of these units in the second language, it becomes necessary to postulate separate underlying cognitive phenomena for first and second language acquisition. Although this might be possible, it seems unlikely and another explanation needs to be found. Rather than arguing that second language acquisition is somehow independent of the first language, it might be more productive to examine second language items in relation to first language items. It may be a situation where there is a subtle interaction between first and second language. The ordering-theoretic method may well be the needed technique to use in that it suggests causal relationships. This technique, when applied to the bilingual child's two languages simultaneously, will be able to reveal if there is any interaction of first and second language, and it may well offer an approach to reconcile the difference between Dulay and Burt's finding of a difference between first and second language acquisition order.

Data from an earlier study (Young, 1971, 1973) was appropriate for such an analysis. In this study, it was found that there was a high degree of similarity between a bilingual child's two languages in the comprehension of 10 numeric comparison categories. Both Spanish-English and Navajo-English bilinguals were used. From this research it was generally concluded that a bilingual child operates with a single semantic system for both

languages because of the high correlations between languages. Although these 10 numeric comparison categories are not documented to be in a particular acquisition order, their difficulty order suggests such, and these categories fulfill the necessary requirements to determine if there can be an interaction between languages — an interaction that might well explain the conflicting finding of two invariant but independent acquisition orders in first and second language.

Applying the ordering-theoretic technique to a bilingual's two languages necessitates using linguistic items that can be argued to be comparable in the two languages. The semantic categories of numeric comparison from Young's study have already been through the process of translation and back translation with native speaker informants and seem to be highly comparable between languages. These semantic categories offer an especially useful basis for investigating the hypothesis that there will be a causal interaction between first and second language for comparable linguistic items.

The 10 semantic categories of numeric comparison that were used in the 1971 study and are the basis for this re-analysis can be best illustrated in tabular form. Table 1 presents the semantic concepts, a definition, and a mnemonic device for each, and Table 2 illustrates the three syntactic types used within each semantic unit.

Table 1

Semantic Concepts of Numeric Comparison

More than	simple plurality	MT
Not more than	denial of simple plurality	NMT
Less than	simple inferiority	LT
Not less than	denial of simple inferiority	NLT
*As many as	many and equal	AMA
*Not as many as	unambiguous inferiority	NAMA
*As few as	few and equal	AFA
*Not as few as	unambiguous plurality	NAFA
Equal to	simple equality	EQ
Not equal to	denial of simple equality	NEQ

* Not present in Navajo

Table 2

Syntactic Types for Semantic Concepts*

There are (not) more X's than Y's.
There is (not) a larger number of X's than Y's.
The number of X's is (not) greater than the number of Y's.

* A single syntactic type used in Navajo.

The original study presented considerable argument that the semantic categories were indeed different in meaning. This re-analysis accepts the original position that there are differences in meaning among all 10 categories and that the translation into New Mexican Spanish and accepted Navajo are essentially correct.

Appendix A includes the ordered script for each language. Note that

the Navajo version contains only six semantic categories and only a single syntactic type. Four semantic categories were omitted because of their non-availability in Navajo without extended paraphrasing, and only one syntactic type was agreed upon by the informants (see Young, 1971). Each child was tested in both of his languages. To equate the testing situation, the Navajo version was extended to include five sentences per available category. Each child then responded to 30 sentences in each language.

The subjects were first and fourth grade students judged to be bilingual and satisfactorily passing a screening test in both languages. The subjects heard the sentences and judged whether a picture on the right or on the left was a correct illustration of the stimulus sentence. The standard controls for order of languages, syntactic types, semantic categories, and picture position were followed. Both accuracy and response time were recorded (see Young, 1971 for details). For this re-analysis study only the first grade children were used to enhance the developmental effect. Syntactic type was ignored (in the earlier study syntax had no significant effect) and accuracy only was used.

In order to apply the ordering-theoretic method, it is first necessary to convert scores to either 1 or 0. It was decided that if a subject got two sentences out of three correct within a category, or three out of five in Navajo, his converted score would be a 1; otherwise it would be 0. The ordering-theoretic technique then compares each category with every other category for the percentage of disconfirming relationships (Bart and Krus, 1973). Between any two categories, there would be four possible sets of scores: 1, 1; 1, 0; 0, 1; and 0, 0. Only one of these discon-

firms the hypothesis that the first category of the pair presupposes the second. If one category presupposes the existence of a second, only a score combination of 1 for the first category and 0 for the second would be impossible or unlikely. Simply stated, you would not expect to get a higher level question correct and a lower level question wrong if the questions have a causal relationship.

To illustrate the total process, let us assume that there are four categories - A, B, C, and D — and five subjects, the array might look like the following:

	A	B	C	D
1	1	0	1	0
2	1	1	0	0
3	0	0	0	0
4	1	0	1	0
5	1	0	1	0

The first step is to calculate the inter-relationships of categories A, B, C, and D. To determine whether A presupposes B, the percentage of disconfirming responses is calculated. As stated before, the only combination of scores that would disconfirm the hypothesis that A presupposes B would be a 1 for A and a 0 for B. In the first array there are three such combinations (subjects 1, 4, 5) for a percentage of 60. The second array or matrix will be the four categories plotted against each other with the percentage of disconfirming responses entered as follows:

	A	B	C	D
A	—	0	0	0
B	60	—	60	0
C	20	20	—	0
D	80	20	60	—

The matrix is read by assuming that the horizontal categories are those that presuppose the existence of the vertical categories. For example, the assumption that A presupposes B is disconfirmed 60 percent of the time; the assumption that A presupposes C is disconfirmed 20 percent of the time. From reading the matrix the branching tree hierarchy can be developed. There is no evidence disconfirming the hypothesis that B presupposes A nor is there any disconfirming evidence that C presupposes A. There is no disconfirming evidence that D presupposes A, B, or C. The tree hierarchy would appear as follows:

The significance of this hypothetical category is that B and C presuppose A and are presupposed by D, but that B and C have no direct causal relationship. The acceptable amount of disconfirming evidence can be set at any acceptable percentage, perhaps as high as 10 percent, rather than a perfect 0 percent.

The same procedure was followed for the data from the original study. The Spanish-English bilinguals produced a 20 by 20 category matrix and a 20 item branching tree hierarchy. The Navajo-English bilinguals produced a 16 by 16 category matrix and a 16 item branching tree hierarchy. The number of categories for the Navajo-English bilinguals was reduced because of the absence of four semantic categories (AMA, NAMA, AFA, NAFA) in Navajo. These categories were considered unavailable in Navajo without extended paraphrasing (see Young, 1971). The two branching hierarchies are on following pages as Figures 1 and 2. These branching hierarchies serve as the basis for the brief description that follows.

Figure 1

Hierarchy of Semantic Categories for Spanish-English Bilinguals

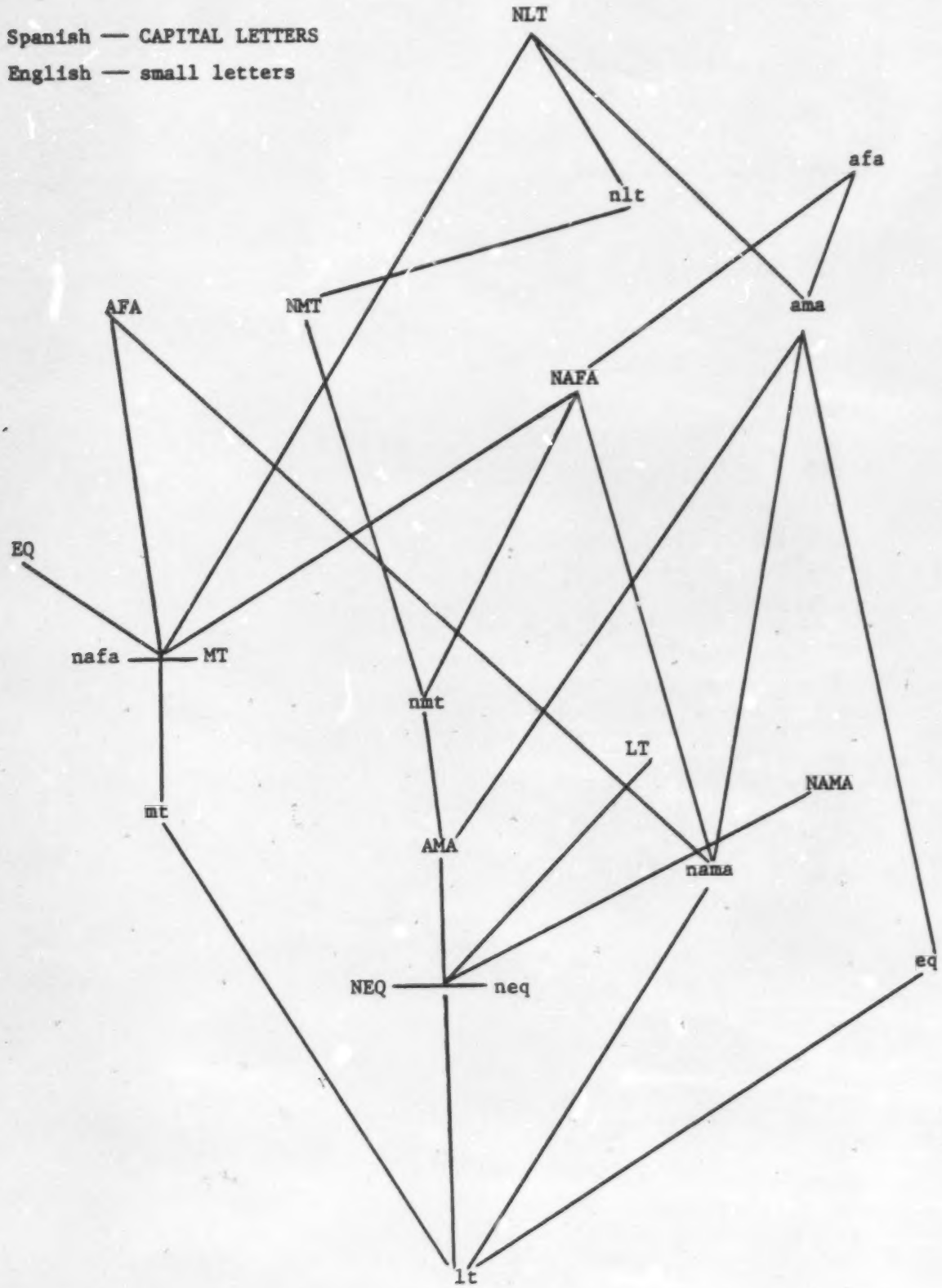
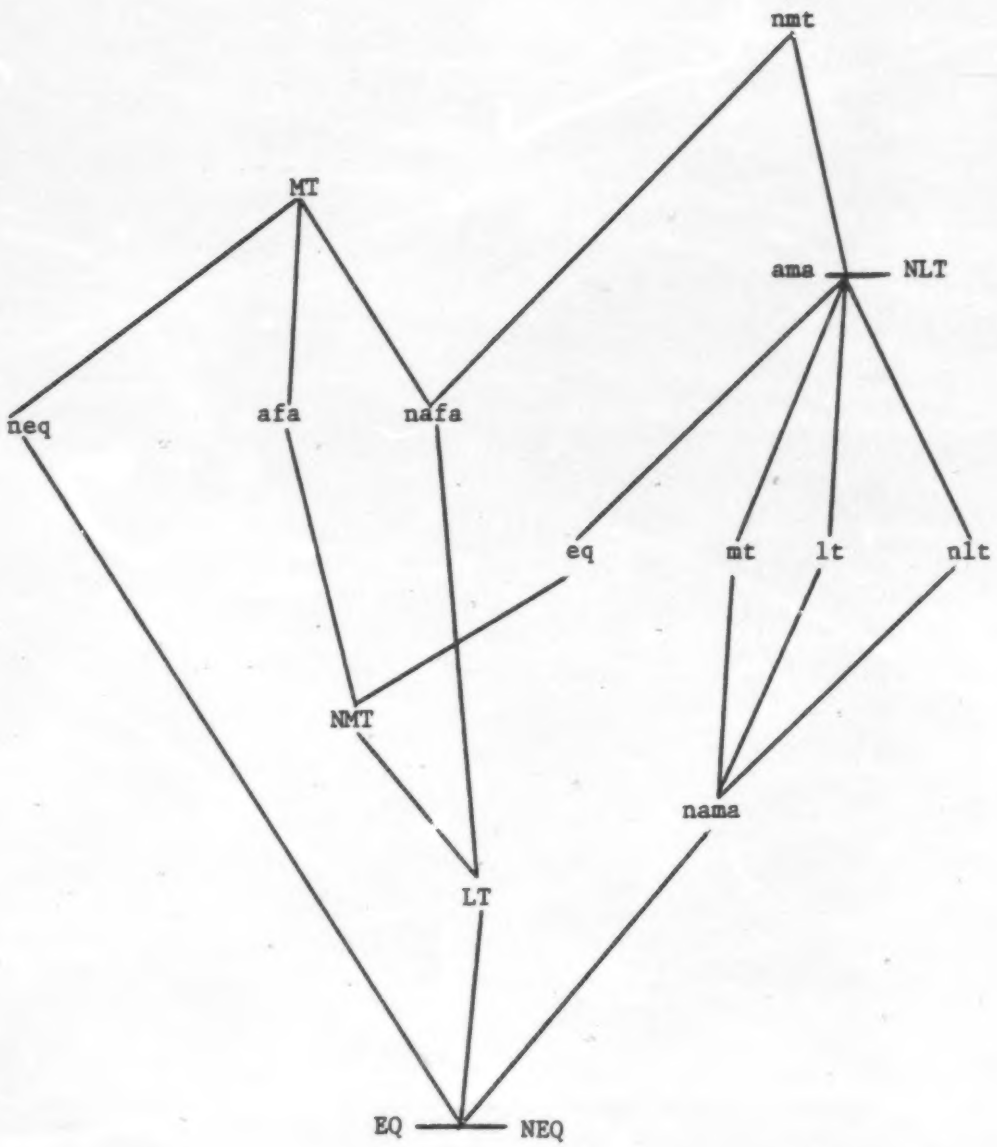


Figure 2

Hierarchy of Semantic Categories for Navajo-English Bilinguals

Navajo — CAPITAL LETTERS

English — small letters



The significant finding for this paper was that there is no clear-cut distinction between the bilingual child's two languages even when in a single domain of numeric comparison. It might be expected that the categories in Spanish or Navajo would tend to be the basis for the English categories. A child might be expected to acquire a certain semantic category in his first language and then in his second language. What resulted from the analysis was a complicated pattern where some categories appeared in Spanish or Navajo first and then in English and where other categories appeared in English first and then in Spanish or Navajo, possibly a reflection of English language schooling. In Figure 1 the English more than ('mt') was a prerequisite for the Spanish more than ('MT'). In Figure 2 the English not less than ('nlt') was a prerequisite for the Navajo not less than ('NLT').

Another finding was that some pairs of semantic categories did not even reveal a causal relationship. Note the 'EQ' and 'eq' in Figure 1 and the 'LT' and 'lt' in Figure 2. In other words, children apparently acquired a semantic category in one language and then acquired a similar category in the other language, independent of the existing category. This occurred twice in the Spanish-English pattern ('ama' + 'AMA' and 'neq' + 'NEQ') and it occurred three times in the Navajo-English pattern ('mt' and 'MT', 'lt' and 'LT', and 'nlt' and 'NLT'). This technique seems to indicate that some items exist as translations and that other items exist independent in each language. This is something of a mixture of compound and coordinate bilingualism even within a restricted domain.

What the bilingual pattern of an ordering-theoretic hierarchy seems to demonstrate is that the notion of linguistic dominance is not limited

to broad domains (Mackey, 1968). It is even a condition for specific linguistic items within a domain. Furthermore, it even suggests a differential first and second language relationship. Some items are based on the comparable items in the alternate language while other items seem to exist independent of the other language. Certainly the branching hierarchies presented in Figures 1 and 2 contain much more information than is being presented, such as indications of developing cognitive abilities and a theoretical puzzle because of the occasional lack of causal relationships between categories and negated categories. (Negated categories seem to be able to exist independent of the non-negated categories.) But for this study only the interaction of comparable items in a bilingual's two languages were considered.

In conclusion, the picture of bilingualism as a psychological phenomenon continues to appear more and more complicated. With the perspective that a bilingual's two languages might well interact in various ways — causally and independently — it might be possible to speculate on the Dulay and Burt (1974c) finding. The invariant order of first language functors reported by Brown (1973) was explained by grammatical and semantic complexity. The invariant order of these same functors when in a second language was not explained; however, if the interaction between first and second language is added to linguistic and semantic complexity, the invariant order of functor acquisition in the second language might be explainable. The parallel of first and second language may exist at a semantic level once it can be determined whether the second language students are relying on their "first" or "second" language for individual items.

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Appendix A

Ordered Script for English, Spanish, Navajo

ENGLISH

A. Simple Plurality

1. There are more trees than brooms.
2. There is a larger number of cups than cars.
3. The number of trucks is larger than the number of balls.

B. Denial of Simple Plurality

4. There are not more cars than tables.
5. There is not a larger number of cups than trees.
6. The number of brooms is not larger than the number of chairs.

C. Simple Inferiority

7. There are less dogs than spoons.
8. There is a smaller number of balls than tables.
9. The number of trees is smaller than the number of trucks.

D. Denial of Simple Inferiority

10. There are not less spoons than cups.
11. There is not a smaller number of cars than tables.
12. The number of trees is not smaller than the number of dogs.

E. Many and Equal

13. There are as many brooms as chairs.
14. There is as large a number of trucks as cups.
15. The number of tables is as large as the number of balls.

F. Unambiguous Inferiority

16. There are not as many tables as cups.
17. There is not as large a number of pencils as brooms.
18. The number of spoons is not as large as the number of trucks.

G. Few and Equal

19. There are as few chairs as pencils.
20. There is as small a number of cups as brooms.
21. The number of chairs is not as small as the number of tables.

H. Unambiguous Plurality

22. There are not as few pencils as cars.
23. There is not as small a number of birds as trees.
24. The number of chairs is not as small as the number of tables.

I. Simple Equality

25. There are equal balls and chairs.
26. There is an equal number of tables and spoons.
27. The number of trees is equal to the number of pencils.

J. Denial of Simple Equality

28. There are not equal cups and trees.
29. There is not an equal number of trucks and chairs.
30. The number of spoons is not equal to the number of dogs.

SPANISH

A. Simple Plurality

1. Hay mas árboles que escobas.
2. Hay mas grande numero de copas que de carros.
3. El número de trocas es mas grande que el número de pelotas.

B. Denial of Simple Plurality

4. No hay mas carros que mesas.
5. No hay mas grande número de copas que de árboles.
6. El número de escobas no es mas grande que el número de silletas.

C. Simple Inferiority

7. Hay menos perros que cucharas.
8. Hay un número mas chiquito de pelotas que de mesas.
9. El número de árboles es mas chiquito que el de trocas.

D. Denial of Simple Inferiority

10. No hay menos cucharas que copas.
11. No hay un número mas chiquito de lápizes que de mesas.
12. El número de árboles no es mas chiquito que de perros.

E. Many and Equal

13. Hay tantas escobas como silletas.
14. Hay tan grande número de trocas como de copas.
15. El número de mesas es tan grande como el de pelotas.

F. Unambiguous Inferiority

16. No hay tantas mesas como copas.
17. No hay tan grande número de lápizes como de escobas.
18. El número de cucharas no es tan grande como el de trocas.

G. Few and Equal

19. Hay tan poquitas silletas como lápizes.
20. Hay tan chiquito número de copas como de escobas.
21. El número de perros es tan chiquito como el de árboles.

H. Unambiguous Plurality

22. No hay tan poquitos lápizes como carros.
23. No hay tan chiquito número de pájaros como de árboles.
24. El número de silletas no es tan chiquito como el de mesas.

I. Simple Equality

25. Hay iguales pelotas como silletas.
26. Hay igual número de mesas y cucharas.
27. El número de árboles es igual con el número de lápizes.

J. Denial of Simple Equality

28. No hay iguales copas y árboles.
29. No hay igual número de trocas y silletas.
30. El número de cucharas no es igual con el número de perros.

NAVAJO

A. Simple Plurality

1. Díí tsin 'íí'áhíígíí, bee nahalzhoohíígíí bilaah áneelą́ą́'.
2. Díí bąąh ha'íizhahíígíí, chidíígíí bilaah áneelą́ą́'.
3. Díí chidítsohígíí, joolíígíí bilaah áneelą́ą́'.
4. Díí bee nahalzhoohíígíí, bik'idah'asdáhíígíí bilaah áneelą́ą́'.
5. Díí chidítsohígíí, baah ha'íizhahíígíí bilaah áneelą́ą́'.

B. Denial of Simple Plurality

6. Díí chidíígíí doo bikáá'adąníígíí bilaah áneelą́ą'da.
7. Díí bąąh ha'íizhahíígíí doo tsin 'íí'áhíígíí bilaah áneelą́ą'da.
8. Díí bee nahalzhoohíígíí doo bik'idah'asdáhíígíí bilaah áneelą́ą'da.
9. Díí tsin 'íí'áhíígíí doo tsíidíígíí bilaah áneelą́ą'da.
10. Díí bikáá'adaníígíí doo bąąh ha'íizhahíígíí bilaah áneelą́ą'da.

C. Simple Inferiority

11. Díí łéechąą'íígíí, béésh 'adee'ígíí bi'oh áneelą́ą́'.
12. Díí joolíígíí, bikáá'adaníígíí bi'oh áneelą́ą́'.
13. Díí tsin 'íí'áhíígíí, chidítsohígíí bi'oh áneelą́ą́'.
14. Díí tsin 'íí'áhíígíí, bee 'ak'e'alchíhíígíí bi'oh áneelą́ą́'.
15. Díí béésh'adee'ígíí, bik'idah'asdáhíígíí bi'oh áneelą́ą́'.

D. Denial of Simple Inferiority

16. Díí béésh 'adee'ígíí doo bąąh ha'íizhahíígíí bi'oh áneelą́ą'da.
17. Díí chidíígíí doo bikáá'adaníígíí bi'oh áneelą́ą'da.
18. Díí tsin 'íí'áhíígíí doo łéechąą'íígíí bi'oh áneelą́ą'da.
19. Díí bik'idah'asdáhíígíí doo bee 'ak'e'alchíhíígíí bi'oh áneelą́ą'da.
20. Díí bąąh ha'íizhahíígíí doo bee nahalzhoohíígíí bi'oh áneelą́ą'da.

E. Simple Equality

21. Díí joolíígíí, bik'idah'asdáhíígíí bił aheenéelt'e'.
22. Díí bikáá'adaníígíí, béésh 'adee'ígíí bił aheenéelt'e'.
23. Díí tsin 'íí'áhíígíí, bee 'ak'e'elchíhíígíí bił aheenéelt'e'.
24. Díí łéechaa'íígíí, tsin 'íí'áhíígíí bił aheenéelt'e'.
25. Díí bee 'ak'e'alchíhíígíí, chidíígíí bił aheenéelt'e'.

F. Denial of Simple Equality

26. Díí bąąh ha'íizhahíígíí, tsin 'íí'áhíígíí doo bił aheenéelt'e'da.
27. Díí chidítsohígíí, bik'idah'asdáhíígíí doo bił aheenéelt'e'da.
28. Díí béésh 'adee'ígíí,łéechąą'íígíí doo bił aheenéelt'e'da.
29. Díí bee 'ak'e'alchíhíígíí, joolíígíí doo bił aheenéelt'e'da.
30. Díí bik'idah'asdáhíígíí, bikáá'adaní doo bił aheenéelt'e'da.